

## Product Data Sheet

# Spirit 4K®

**High-Performance Film Scanner  
with Bones and DataCine®**



The Spirit 4K® from DFT Digital Film Technology is a high-performance, high-speed Film Scanner and DataCine® solution for Digital Intermediate, Commercial, Telecine, Restoration, and Archiving applications.

With more than 350 systems shipped worldwide in the past decade, the Spirit has become the undisputed preference for telecine and high-speed film scanning applications. Now the Spirit 4K® system offers a quantum leap in performance, with a maximum native resolution of 4K and with native 2K scanning available in real time.

The Spirit 4K system is available in two basic versions: a high performance film scanner connected to a DFT Bones open post-production system via a high-speed Infiniband interface, which can be upgraded to a full-featured system that includes interfaces for standard- and high-definition (SD and HD) video; and a DataCine® which includes SD and HD video outputs and which can be enhanced with a Bones system, including 4K/2K high speed Infiniband data interfaces.

### Spirit 4K Film Scanner/Bones Combination

Digital intermediate production – the motion picture workflow in which film is handled only once for scanning and then processed with a high-resolution digital clone that can be down-sampled to the appropriate output resolution – demands the highest resolution and the highest precision scanning.

While 2K resolution is widely accepted for digital post production, there are situations when even a higher resolution is required, such as for digital effects. As the cost of storage continues to fall and ultra-high resolution display devices are introduced, 4K postproduction workflows are becoming viable and affordable.

The combination of the Spirit 4K high-performance film scanner and Bones system is ahead of its time, offering you the choice of 2K scanning in real time (up to 30 frames per second) and 4K scanning at up to 7.5 fps depending on the selected packing format and the receiving system's capability. In addition, the internal spatial processor of the Spirit 4K system lets you scan in 4K and output in 2K. This oversampling mode eliminates picture artifacts and captures the full dynamic range of film with 16-bit signal processing. And in either 2K or 4K scanning modes, the Spirit 4K scanner offers unrivalled image detail, capturing that indefinable film look to perfection.

### *Bones post production workflow solution*



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## Key Features

- Multi-film format, high-resolution, real-time film scanning
- FA 35 mm and ACA 35 mm 2-perf / 3-perf / 4-perf film formats
- Scanning head capable of:
  - Native 2K scanning up to 30 fps
  - Native 4K scanning up to 7.5 fps
- Safe continuous-motion film transport including:
  - Variable scanning speeds
  - Visible search
- Eastman Kodak-designed, high-resolution, advanced-imaging subsystem:
  - Diffuse, high-power xenon illumination system to optically suppress dust and scratches
  - Custom precision optics
  - Optical film matching for print, negative, and intermediate stocks
  - Optical gain control
- Built-in 4K image processing based on a 16-bit RGB data stream for extended black definition (EBD):
  - Automatic FPN and shading correction
  - Automatic focus adjustment
  - Automatic Dmin adjustment
  - Logarithmic masking
  - User-definable look-up tables (LUTs)
  - RGB negative matching
  - RGB primary color correction with extended color-correction mode
  - Aperture correction
- Real-time scaling engine for sizing and positioning up to 4K output resolutions and for converting 4K scans to 2K (digital oversampling)
- Film Scanner version: High speed optical Infiniband data output up to 4K
  - DPX file format
  - Includes Bones Transfer application running on a Linux-based PC
  - TV-gamma, linear, logarithmic, user defined transfer characteristics up to 16-bit quantization
  - Image monitoring with selectable display look-up tables and resolutions up to SXGA resolution
- DataCine version: Video output supports all major digital HD and SD formats
  - TV-gamma, linear, and logarithmic transfer characteristics
  - Rotation
  - Contour correction

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## Spirit 4K DataCine

Through an internal spatial processor, the Spirit 4K DataCine supports all important digital HD/DTV and SD standards in 4:4:4, YUV, or RGB formats, so you can rapidly output your material to tape or disk. In addition, you can upgrade the Spirit 4K DataCine at any time with a Bones system to deliver image files to a storage system.

## Unmatched Color Performance

At the heart of the Spirit 4K system is the proven concept of a broad spectrum light source with a precision active-feedback loop to ensure consistency of image output, not just from moment to moment but across days, weeks, and months. Spirit DataCine users across the world have demonstrated that a color decision list can always be recalled with the confidence that it will be reproduced.

The Spirit 4K system uses a long-life 700W xenon lamp. Xenon illumination provides a broad and continuous spectrum of light across the entire visible area, with an emphasis in the critical short-wavelength blue area. The result is a consistently noise-free image right across the color spectrum, without problems in the blue portion that trouble other film-scanning technologies.

Like the original Spirit DataCine system, the xenon lamp output passes through an integration cylinder to

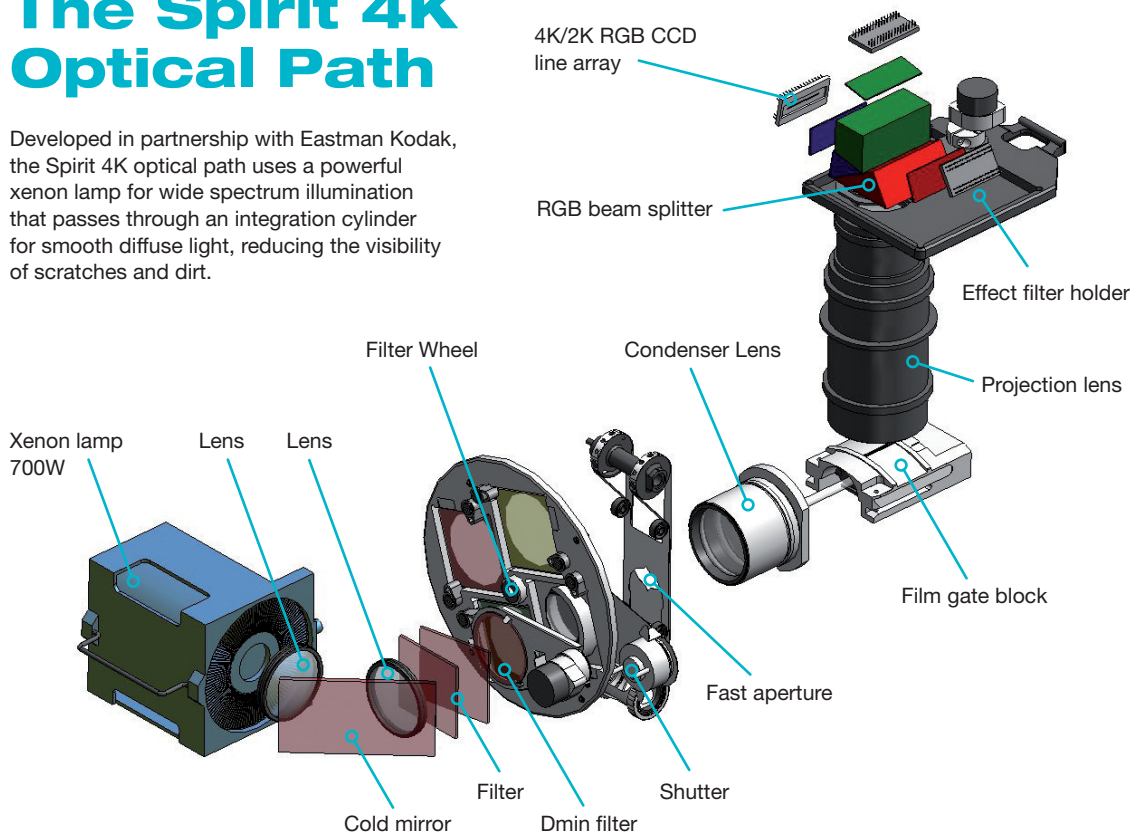
create a highly diffuse light source. This diffuse light source has proved highly successful at minimizing the visible effects of film scratches and even some small dust particles.

In digital intermediate work, the normal practice is to scan the original camera negative to capture the best possible quality. The high blue content in the xenon light source of the Spirit 4K system is a significant aid in balancing out the orange mask of negative and intermediate stocks to achieve the most natural, most visually satisfying image quality.

The Spirit 4K system features new lens gate assemblies designed for Super 16 mm and full-aperture 35 mm film that are capable of scanning the Standard and Academy versions. The optical system also includes a filter drawer to allow the use of standard camera filters for optical effects during scanning.

## The Spirit 4K Optical Path

Developed in partnership with Eastman Kodak, the Spirit 4K optical path uses a powerful xenon lamp for wide spectrum illumination that passes through an integration cylinder for smooth diffuse light, reducing the visibility of scratches and dirt.



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## Effective Digital Intermediate Workflow

The Spirit 4K system brings an unmatched efficiency in creating a digital intermediate (DI) from film. The unsurpassed high scanning speeds are complimented by features to support a smooth and fast scanning process.

The Spirit 4K platform includes a special set of scanner menus for the graphical control panel (GCP). These menus hide typical telecine controls and restrict control to those functions required for a DI transfer. This capability reduces the risk of setting the wrong parameters during transfers, which are not supervised by a colorist.

The AutoFocus feature of the Spirit 4K system automates the focus adjustment process and centers the focus corridor on the film emulsion. It offers a fast, easy, and accurate way of focusing at the beginning of the scanning process.

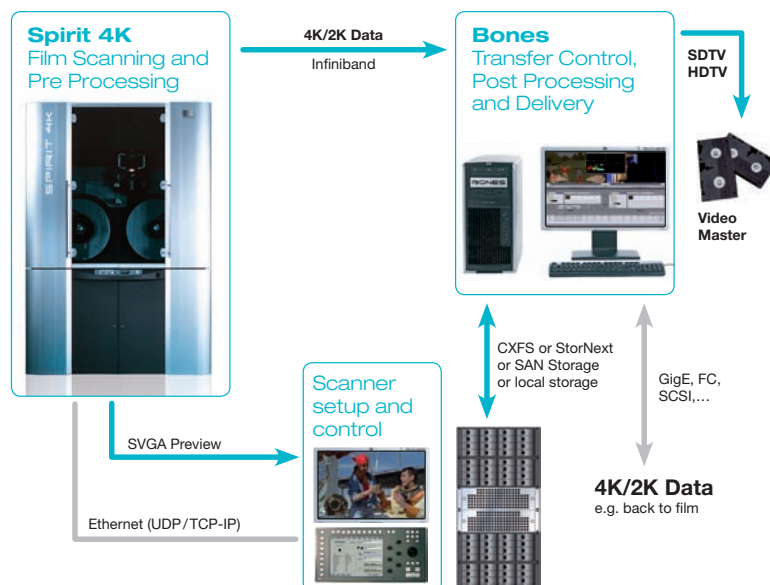
The matching process can be automated by the AutoDmin feature of the Spirit 4K system. It automatically neutralizes the color differences in the most transparent part of the film (Dmin) and sets it to the correct value for a DI transfer. In a current-settings mode the AutoDmin correction is based on density range (Dmax) settings taken from film stock or TK memories or from a user-defined Matching Lift adjustment. In a densities-settings mode you can preset the Dmax in a range of 0.1 to 3.5 densities.

The PrinterLights option of the Spirit 4K system allows you to generate and store settings for numerous film stocks. Based on these film stocks and a display calibrated to a print look, color correction can be performed in printer light steps and respective feedback can be given to a director of photography.

The PrinterLights option implements the functional part of a digital Hazeltine into the Spirit 4K system. It includes the generation and storage of color-matching settings for various film stocks as a reference for the subsequent printer-lights definition in R, G, B, and master.

You can augment this special DI feature set with an event-list option for scene-by-scene corrections and the Bones system pull list support for list-controlled transfers based on frame count, timecode, or keycode.

## Spirit 4K Data Application with Bones



The combination of the Spirit 4K high-performance film scanner and Bones open post-production system scans film in 2K or 4K resolution, which is then stored on disk using the Bones Transfer and Bones Mover applications. In the diagram below, the Spirit 4K system is set up with a graphical control panel (GCP), which is part of the basic scanner unit. The 4K/2K data is then post processed via the Bones system and formatted into the desired output format: data, SD, or HD.



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## Signal Processing

From the lens gate, the light modulated with the film image goes to a beam splitter where it is divided optically into red, green, and blue components. Each color path has its own CCD sensor which has two CCD line arrays: one with 2,048 pixels for 2K scanning and one with 4,096 pixels for native 4K scanning.

The output from the CCDs is passed through low-noise pre-amplifiers prior to analog-to-digital conversion. From that point, all the digital signal handling and internal processing of the Spirit 4K system takes place at 16 bits up to the output stage for maximum dynamic range and headroom.

The internal spatial processor, which also operates at 16-bit quality, allows you to resize and crop an image as necessary. This processor also provides the precision downsampling you need to derive 2K images from 4K scans.

The Spirit 4K system includes standard and extended primary (RGB) color correction which can be controlled with a DFT GCP. As well, you can control a Spirit 4K system using, for example, a DaVinci telecine controller. You can also install a DFT Scream Plus Grain Manager and a 4K/2K six-sector color processor in the internal signal path of the Spirit 4K system for complete control over the texture and the color of the image output.

## HD and SD Video Outputs

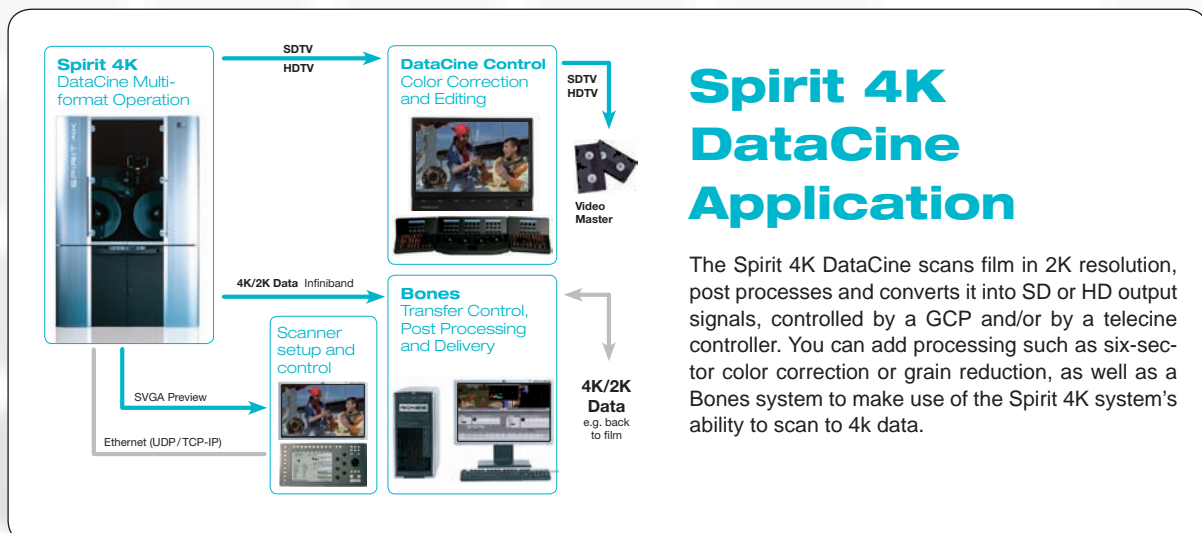
For quickly outputting film materials to video, the Spirit 4K DataCine system includes video output interfaces (optional on the Spirit 4K high-performance film scanner and Bones system combination). The system's native 2K scan is converted to the selected video standard. You can then perform realtime continuous X-Y pan and zoom, anamorphic unsqueeze 2:1, independent X and Y sizing, format presets, digital output blanking, and continuous 360° image rotation. You can add these processing functions to the combined Spirit 4K high-

performance film scanner and Bones system to provide complete multi-format functionality.

## High-Speed Infiniband Interface

Scanning film at 2K and 4K resolutions requires a high-speed data interface. With practical transfer rates in excess of 500 MB/s, the Infiniband interface has no problem handling real-time 2K resolution files and can sustain 4K resolution output at rates up to 7.5 fps, depending on the selected packing format and the receiving system's capability.

In addition, the Infiniband interface comes with an SXGA output that you can calibrate to monitor a high-resolution scan without a dedicated workstation. The Bones workstation provides an interface to external graphics and compositing systems.



## Spirit 4K DataCine Application

The Spirit 4K DataCine scans film in 2K resolution, post processes and converts it into SD or HD output signals, controlled by a GCP and/or by a telecine controller. You can add processing such as six-sector color correction or grain reduction, as well as a Bones system to make use of the Spirit 4K system's ability to scan to 4k data.

## Specifications

Mechanical Dimensions	- Dimensions: 1,390 mm (54.73 in.) wide, 1,981 mm (78.00 in.) high, 915 mm (36.03 in.) deep - Weight: Approximately 550 kg (1,212 lbs.)
Electrical AC Power Supply	3-phase AC power recommended: 3x 400V at 50 Hz or 3x 208V at 60 Hz
Electrical Power Consumption	Approximately 3.5 kVA, typically
Film Size Format	- Full aperture (Super) 35 mm, Academy 35 mm - 2-perf, 3-perf, 4-perf - 8-perf/VistaVision (option) - S16 mm or 16 mm (option)
Film Transport	Direct servo-controlled capstan drive
Fixed Speeds	- 25, 12.5, 6.25 fps at 625 lines/50 Hz - 29.97, 23.98, 17.98, 11.99, 5.99 fps at 525 lines/59.94 Hz - 30, 24, 18, 12, 6 fps at HDTV/60 Hz - 29.97, 23.98, 17.98, 11.99, 5.99 fps at HDTV/59.94 Hz - 25, 12.5, 6.25 fps at HDTV/50 Hz in forward and reverse
Select-a-Speed	2.00 to 30.00 fps in forward and reverse, up to 7.5 fps in 4K or 4K to-2K mode (35 mm 4-perf film)
Stop Mode	Frame accurate with full-quality color processing in stop; single frame step forward and reverse with full resolution
Variable Visible Search	With full picture size: - 16 mm 5 fps – 150 fps (upper limit adjustable to 600 fps) - 35 mm 4-perf 2 fps – 75 fps (upper-limit adjustable to 240 fps)
Picture Stability	Better or equal $\pm 10 \mu\text{m}$ (35 mm, 16mm) measured with DFT test tools
Framing Adjustment	$\pm 60\%$ of total frame height
Film Capacity	- Up to 1200m (3,937 ft.) on spools - Up to 900m (2,952 ft.) on cores
Control Interface	Ethernet UDP/IP or TCP/IP for all Spirit 4K functions
Light Source	700W xenon lamp
Optical Matching Filters	Print, negative, and intermediate
Focus	Remote manual or automatic mechanical focus control
CCD Pickup Device	Linear CCD sensor with RGB beam splitter switchable between 4K or 2K resolution
Scanned Pixel Size on	- Approximately $6.08 \mu\text{m} \times 6.08 \mu\text{m}$ (35 mm 4-perf, 4K mode) - Approximately $12.17 \mu\text{m} \times 12.17 \mu\text{m}$ (35 mm 4-perf, 2K mode) - Approximately $3.06 \mu\text{m} \times 3.06 \mu\text{m}$ (16 mm, 4K mode) - Approximately $6.11 \mu\text{m} \times 6.11 \mu\text{m}$ (16 mm, 2K mode)
White Shading	Automatic correction to $\leq 1\%$ at 100% linear signal, static

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Signal/Noise Ratio	Red, green, blue better than 55 dB (unweighted, CRT gamma, 4K or 2K mode)
Masking	Logarithmic (masking)
Aperture Correction	Horizontal and vertical -4 dB to +12 dB at peaking frequency, peak frequency adjustable
Digital Color Correction	- RGB matching - Automatic Dmin - PrinterLights (option) - RGB primary control (lift, gamma, and gain) - RGB extended control (coupled black, uncoupled black & white)
Image Resolution	- 256 – 4,096 horizontal pixels - 256 – 3,124 vertical lines (35 mm 4-perf) - Adjustable and presets - 4K to 2K conversion
Image Functions	- Continuous image rotation - 360° for 16mm and 2-/3-/4-perf - 20° for 8-perf 35mm
Contour Correction	- Spirit 4K DataCine or video option - 12 dB to +8 dB, at peaking frequency, peak frequency adjustable
<b>625/525 Functions (Spirit 4K DataCine or video option)</b>	
TV standards	- 625/50, 525/59.94, 2:1 interlace CCIR 601, CCIR 656 - 4:4:4 or 4:2:2 or 8:4:4 10-bit digital
Display formats	4:3 and 16:9 full screen and horizontal/vertical letterbox
Zoom range	Typical area magnification 0.1X to 16X
625/525 resolution	35 mm: not more than 3 dB down at 400 lines (5 MHz) in center and corner (film losses not taken into account)
Digital video out	- CCIR link A/B, serial 2x2 BNC - TV gamma, logarithmic or linear characteristic
<b>HDTV Functions (Spirit 4K DataCine or video option)</b>	
TV standards/2:1 interlace	1920x1080/50, 60, and 59.94 Hz
TV standards/progressive	- 1280x720 / 60, 59.94 and 50 Hz - 1920x1080 / 30, 29.97, 25, 24, and 23.98 Hz
TV standards/segmented frame	1920x1080/24 and 23.98 Hz
Display formats	16:9 full screen and horizontal/vertical letterbox

## Specifications continued...

X-Y zoom	Typical area magnification 0.05X to 9X
HDTV resolution	Not more than 3 dB down at 24 MHz in center and corner for 35 mm 3-perf/4-perf and 16 mm (film losses not taken into account)
Digital video out	<ul style="list-style-type: none"> <li>- CCIR Link A/B, serial 2x2 BNC</li> <li>- 4:2:2 Y, Cb, Cr or 4:4:4 Y, Cb, Cr, or R, G, B</li> <li>- 10-bit per pixel</li> <li>- TV gamma, logarithmic or linear characteristic</li> </ul>
External reference	BNC input for tri-level sync
<b>Data Output Functions (Spirit 4K film scanner/Bones, 4K/2K Bones Data option)</b>	
File format	DPX according to SMPTE 268M-1994
Transfer characteristics	TV gamma, linear, logarithmic, user defined output
Image monitoring	<ul style="list-style-type: none"> <li>- Display characteristics selectable via display look-up tables</li> <li>- Resolution presets up to 1280x1024 (SXGA)</li> <li>- Connector mini D-sub 15-pin</li> </ul>
Components and packing:	<ul style="list-style-type: none"> <li>- 3x 16-bit, RGB</li> <li>- 3x 10-bit, RGB filled to 32-bit with padding at bits 0 and 1</li> <li>- 4x 8-bit, RGBA packed to 32-bit, Alpha (A) = space ("0")</li> <li>- 3x 10-bit, Y-only filled to 32-bit with padding at bits 30 and 31</li> <li>- 2x 16-bit, Y-only packed to 32-bit</li> </ul>
<b>Bones Workstation</b> The Bones workstation is offered with Infiniband data interface but without any disk storage. For operation with the Bones Transfer application at least one disk array is required. The Bones Workstation is supplied with Bones Framework, Bones Transfer, and Bones Mover licenses.	
<b>System performance*</b>	
Related film speed	<ul style="list-style-type: none"> <li>- Up to 24 frames/s at 2K (2048x1556/3X 10-bit RGB filled to 32 bits)</li> <li>- Up to 6 frames/s (4096x3124/3X 10-bit RGB filled to 32 bits)</li> </ul>
Waveform monitoring test points	Color signals at the output of several processing stages
Display	<ul style="list-style-type: none"> <li>- Parade or superimposed waveform</li> <li>- Vector, image, and mixed mode</li> </ul>
Signal format	1280x1024, SXGA/75 Hz
WFM controls	Test point, display, signal format
Connector	Mini D-sub 15-pin analog output to a SXGA monitor (monitor not included)
*Note: The achievable data transfer speed depends on the overall system performance and might be subject to variations. Parameters such as the connected storage, the connections between storage and host and the type of file system are of major impact.	

Technical specifications are subject to change without notice

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## Ordering Information

000129560510	SFS 4101 B-IB	Spirit 4K high-performance Film Scanner/Bones combination High-resolution, fast 4K/2K film scanner with Bones workstation
000129560510	SDC 4100	Spirit 4K DataCine High-resolution, fast 4K/2K film scanner with digital HDTV and SDTV interfaces
000129708210	FH 7082.1	Power configuration 240V/400V for three-phase power supply
000129708110	FH 7081.1	Power configuration 115V/208V for three-phase power supply
000129705210	FH 7052.1	Power terminal unit 230V/1-P, 208V/2-P power configuration either for 230V single phase or 208V/twophase
000129692900	FD 0709.1	Reel drive set (DIN specs.) c/with spindles of 9 mm diameter (EU)
000129692800	FD 0708.1	Reel drive set (ANSI specs.) c/with spindles of 8 mm diameter (US)
000128220110	4K S16 LGA	Super 16 mm lens gate assembly for scanning of 16 mm and Super 16 mm film
000128220510	4K 35 GB	35 mm film gate with Academy projection aperture for format adaptation in the FA 35 mm lens gate assembly
000128220210	4K 16 GB	16 mm film gate for 16 mm film format adaptation in the Super 16 mm lens gate assembly
000128712910	FH 7129	Audio scanner, Comopt 16/35 mm (Available for all countries except European Community)
000129536150	41/21-B-IB-O	4K/2K Bones data option, optical data output, SXGA preview output, Bones workstation incl. display; Framework, Transfer, Mover software; and data input interface
000129536130	41/21-VIDEO-O	Spirit 4K/2K/HD video option, SDTV and HDTV format processing incl. rotation and digital outputs
000128761510	S4K-VVO	VistaVision, 35 mm 8-perf film format
000129760610	41/21-6SC-O	4K/2K/HD six-sector color processor

000129760410	41/21-GRAIN-O	Scream Plus Grain Manager
000128655110	GCP-EVL	Event list function for GCP
000128761910	S4K/2K-PL	Spirit 4K/2K/HD Printer-Lights option
<b>Technical Support Services &amp; Training</b>		
	SpiritHD/2K/4K-SP	Spirit HD/2K/4K on-site StartPro commissioning and brief product overview
	SpiritHD/2K/4K-Bones-SP	Spirit HD/2K/4K Film Scanner/Bones on-site StartPro commissioning
	SpiritHD/2K/4K-OST	3-day Spirit HD/2K/4K on-site operational training



## Unparalleled Engineering and Quality

The DFT Digital Film Technology engineering, research and development, sales and support team is known for their excellence in technology, design, quality, and customer service with products such as the SCANITY™ Film Scanner, Spirit DataCine and Scanner family, Shadow telecine, Bones and Bones Dailies software solutions, Scream Plus grain manager, as well as the LUTher color space converter.

## Technical Support Services & Training

The DFT Digital Film Technology Technical Support Services & Training team offers complete service solutions that enhance your return on DFT products and global system solutions.

Advanced training and proactive support reduce down time, and keep your equipment and staff performing at optimum productivity.

The pre-packaged suite of DFT Services provides support throughout the entire process:

- Commissioning support
- On-site repair and maintenance services
- Hotline 24 hours a day, 7 days a week
- Comprehensive software and hardware support
- Advanced exchange hardware support
- Hands-on training classes

The worldwide, experienced DFT Digital Film Technology Technical Support Services & Training experts can assist you with customized solutions.

## Headquarters



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